

BOTANICAL MUSEUM LEAFLETS

HARVARD UNIVERSITY

CAMBRIDGE, MASSACHUSETTS

WINTER 1983

VOL. 29, No. 1

ETHNOBOTANICAL NOTES ON *STEVIA*¹

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Stevia is an entirely New World genus of herbs and shrubs belonging to the Compositae. Its distribution range extends from the southern United States to northern Argentina, with particular concentration along the Andean mountains. A taxonomic revision of the North American members of the genus was recently completed (Grashoff, 1972), but the South American members remain to be studied systematically. According to Grashoff's revision, 81 species occur in the Americas north of the Colombo-Panamanian border, of which 70 species are found in Mexico alone. Based on the scattered taxonomic treatments of members of this genus in the past, in particular those of Robinson (1930a-c, 1931a-c, 1932a-b), an estimate of 120 species for the South American *Stevia* may be given.

One member of the genus, *Stevia Rebaudiana* (Bertoni) Bertoni, possesses a characteristic sweet taste in its leaves, and apparently has been used as a sweetening agent since antiquity

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by the natives of Paraguay, where the plant is indigenous (Gosling, 1901; Bertoni, 1905, 1918; Sakaguchi and Kan, 1982). Research on the sweetening properties of this species was initiated at the onset of this century, and much is now known about this plant and its constituents. Felipe (1977), Tanaka (1980) and Sakaguchi and Kan (1982) have reviewed the progress and status of research in this area.

Within the past ten years, extracts of *S. Rebaudiana* and stevioside, one of the sweet principles isolated from the plant, have been introduced for use in Japan as sweetening agents and as dietary sucrose substitutes (Sumida, 1973; Abe and Sonobe, 1977; Fujita and Edahiro, 1979; Kazuyama, 1979). The sweetening power of stevioside has been evaluated at 100–300 times that of sucrose, depending on the concentration of sucrose used for comparison (Kamiya et al., 1979).

As a continuation of our current interest in the search of vegetal sweeteners as possible dietary sucrose substitutes (Kinghorn et al., 1982), we have surveyed the literature of *Stevia*, in the hope of finding new leads for the discovery of other sweet-tasting species within the genus. Additionally, field work in Mexico and South America was conducted to inquire of the uses of members of *Stevia*. The results of this field work have been published elsewhere (Soejarto et al., 1983).

As a result of our literature survey, a significant amount of ethnobotanical information concerning members of *Stevia* was uncovered. Contrary to expectation, very little information was found relating to the possible existence of other sweet-tasting *Stevia* species, with the great majority concerned with primarily medicinal uses. These data are presented in this paper to stimulate further research and hopefully will lead to the discovery of additional biologically active compounds from this plant group.

Since there is no current unified classification for *Stevia* throughout its range, the following ethnobotanical data are presented in alphabetical order, according to species. Should the status of a Latin binomial be considered questionable, comments on nomenclature and taxonomy are given.

Certain data have been obtained directly from herbarium specimens of *Stevia* deposited at the John G. Searle Herbarium,

Field Museum of Natural History, Chicago. When this source of data is indicated in the text, the botanical institution is abbreviated as *F*, for the sake of brevity.

NOTES ON *STEVIA* ETHNOBOTANY

Stevia balansae Hieron. in Bot. Jahrb. Syst. 22: 379. 1897.

In the village of Nueva Colombia, near Asunción, Paraguay, the populace drink a decoction prepared from the roots of this species, locally known as *Charúa kaá*, in cases of diarrhea (Soejarto et al., 1983).

Stevia bogotensis Tr. ex Cortés, Flora de Colombia 153. 1919.

According to Cortés (not dated), a plant with this Latin binomial, known locally as *Jarilla* and *Eupatoria*, is used in Colombia as a febrifuge and diaphoretic. This same source indicates that this information applies to other species of the genus in the Bogota area of Colombia. Pérez-Albeláez (1937) added that this plant is used in the Yacopi region of Colombia as a diaphoretic, and is known as *Eupatoria*, *Clavito* and *Eupaloria*.

The Latin binomial *S. bogotensis* is not listed in *Index Kewensis* (1895–1981) and elsewhere, and appears to be an invalid name. Probably, it refers to *Stevia lucida*, which is common in the Bogota area (see below under *S. lucida*), but its correct identity is obscure.

Stevia caracasana DC., Prodr. 5: 121. 1836.

According to von Reis Altschul (1973), a note on the label of an herbarium specimen (*Jahn 1098*) collected in Venezuela in 1922, and identified as *S. elongata* HBK. var. *caracasana* (DC.) B. L. Robins., states that this plant is known as *Molinillo*. Gra-shoff (1972), however, considered that this taxon is synonymous with *S. caracasana* DC.

Stevia cardiatica Perkins in Bot. Jahrb. Syst. 49: 221. 1913.

This plant has been reported to be used in the treatment of heart diseases (Robinson, 1932b; Cardenas, 1943).

Stevia connata Lag., Gen. Sp. Nov. 27. 1816.

A note on the label of an herbarium specimen (*Steyermark 50493* at *F*) collected in Huehuetenango, Guatemala, in 1942, states that this species is known as *Pericón de monte* and is reputed to be used in treating stomachaches.

Stevia cuzcoensis Hieron. in Bot. Jahrb. Syst. 40: 363. 1908.

This plant is known as *Chipi-cuca* in the Cuzco area of Peru (Herrera, 1930, 1939; Soukup, 1970), but no uses are indicated. However, Herrera (*ibid.*) mentioned that this name also applies to *Polypodium subvestitum* Maxon and *P. Buchtienii* Christ. and Rosenst.

Stevia dictyophylla B. L. Robins. in Proc. Amer. Acad. Sci. 44: 617. 1909.

In Mexico this plant is known as *San Marcos* in the State of Jalisco (Martínez, 1979), but no uses are recorded.

Stevia elatior HBK., Nov. Gen. Sp. Pl. 4: 144. 1820.

According to Lipp (1971), who lived among the Chinantec-speaking people of San Pedro Sochiapam in Oaxaca, Mexico, for a period of six months, the leaves of this plant are used to soothe burns and scratches. The plant is reported to be known as *A-cí*.

Stevia Eupatoria (Spreng.) Willd. in Linnaeus, Sp. Pl. 3(3): 1774. 1804.

Known as *Hierba del borrego*, *Yerba del borrego* and *Cola del borrego*, this species has been reported as being used as a diuretic and antimalarial, and is toxic to livestock (Flores, 1907; Martínez, 1979).

Under the name of *Stevia purpurea* Pers., Roig y Mesa (1953) listed this plant as having been introduced and cultivated in Cuba, where it is known as *Estevia*. Grashoff (1972) considered this Latin binomial to be synonymous with *Stevia Eupatoria* (Spreng.) Willd.

Stevia glandulosa Hook. and Arnott, Bot. Beech. Voy. 296. 1840.

Von Reis Altschul (1973) reported that a note on the label of an herbarium specimen collected in 1927 at San Sebastian in Jalisco, Mexico, states that this species is “used medicinally in fevers”. According to Martínez (1979), the common names of this species in Mexico are *Hierba de la pulga* (Oaxaca) and *Merba* (Nayarit).

Stevia hirsuta DC., Prodr. 5: 121. 1836.

A note on the label of an herbarium specimen (*Molina and Molina 26641* at *F*) collected in 1971 at Los Encuentros, Guatemala, states that this species is known as *Oreja de ratón*. No uses are indicated.

Stevia jorullensis HBK., Nov. Gen. Sp. Pl. 4: 112. 1818.

A note on the label of an herbarium specimen (*Molina and Molina 26700* at *F*) collected in 1971 at Chimaltenango, Guatemala, states that this species is known as *Mejorana*, with no other details. In the Federal District of Mexico, the species is known as *Roselina* (Martínez, 1979).

Stevia Lehmannii Hieron. in Bot. Jahrb. Syst. 28: 562. 1901.

A note on the label of an herbarium specimen (*Molina and Molina 26296* at *F*) collected in 1971 at Huehuetenango, Guatemala, states that this species is known as *Oreja de ratón*, with no other details.

Stevia lucida Lag., Gen. Sp. Nov. 28. 1816.

This species is widely distributed from Mexico to Venezuela, with four different varieties recognized by Grashoff (1972): var. *lucida* (Mexico), var. *Robinsoniana* Grashoff (Mexico), var. *bipontini* B. L. Robins. (Mexico) and var. *oaxacana* (DC.) Grashoff (Mexico to Venezuela).

The species is known under many names. In Mexico, it is called *Yerba del aire* (Guanajuato) (von Reis Altschul, 1973) and *Hierba de la araña* (Oaxaca) (Martínez, 1979), in Guatemala *Kebuj* (Totonicapán) (Anonymous 1929a), in Colombia *Chilca* (Pérez Arbeláez, 1936) and *Golondrina sabanera* (Soejarto et al., 1983), and in Venezuela *Chirca* (von Reis Altschul, 1973) or

Chilca (Morton, 1975). Under the name of *Stevia glutinosa* HBK., a synonym of *S. lucida* Lag. (Grashoff, 1972), Pérez Arbeláez (1936, 1937) indicated that the plant is known as *Javillo* or *Jarilla*. Additionally, a note on the label of an herbarium specimen (*Molina and Molina 26709* at *F*) collected in 1971 at Chimaltenango, Guatemala, states that *S. lucida* is known as *Mariposa*.

Several uses have been attributed to this species. Under the name of *S. glutinosa* HBK., Pérez Arbeláez (1936) stated that this species is used externally to soothe pains. According to a note on the label of an herbarium specimen collected in Colombia in 1927, the plant is "used for inflammation" (von Reis Altschul, 1973). A recent field study in the Bogotá area of Colombia (Soejarto et al., 1983) confirmed that a decoction prepared from the aerial parts of this plant is used to soothe inflammation. In Guatemala (Totonicapán) the plant is used to treat rheumatism (Anonymous, 1929a), and according to Morton (1975), who made an evaluation of folk remedies of northern Venezuela, the leafy stems of *S. lucida* are "... sold in bunches in Maracaibo, ... boiled, and the resinous decoction is employed to alleviate rheumatism".

In Mexico, it is interesting to note that the common name *Yerba del aire* may in fact give an indication of the use of this species. According to the Mexican folk medicine, the word *aire* is used to indicate a condition which results when a person comes in contact with *malos aires* (bad air), such as chilly cramps (Díaz, 1976b, p. 316; Latorre and Latorre, 1977). A plant with this name, therefore, may be used to treat such a condition (Martínez, 1969, p. 430).

Stevia Macbridei B. L. Robins. *var. anomala*. B. L. Robins. in *Contr. Gray Herb.* 96: 9. 1931.

Known as *Gualamoco* in the Jauja-Huancayo area of Central Peru, this species has been reported to be used for the preparation of a bath by women (Soejarto et al., 1983). For this purpose, the whole plant is decocted.

Stevia monardifolia HBK., *Nov. Gen. Sp. Pl.* 4: 115. 1818. (Often misspelled as *monardaefolia*; cf. Grashoff, 1972).

This plant is known as *Mara Antonia* by the people of Zita-
cuaro, State of Michoacán, Mexico (Soejarto et al., 1983), but
no uses are known.

Stevia Nelsonii B. L. Robins. in Contr. Gray Herb. 80: 9. 1928.

In the State of Michoacán, Mexico, this plant is known as
Hierba de la paloma, but no uses are known (Soejarto et al.,
1983).

Stevia nepetifolia HBK., Nov. Gen. Sp. Pl. 4: 146. 1820.

According to Martínez (1979), this species is known as *Zazal*
in the State of Sinaloa, Mexico. In Guatemala, according to a
note on the label of an herbarium specimen (*Ruano 1268 at F*)
(undated), this plant is known as *Anís de ratón*.

Von Reis Altschul reported (1973) that a note on the label of
an herbarium specimen (*Grant 632*) collected in Guatemala in
1940 and identified as *S. rhombifolia* HBK. states that this plant
is known as *Peracón*, and that a tea is prepared in case of dys-
menorrhea. Later taxonomic study (Grashoff, 1972) showed
that *Grant 632* belongs to *S. nepetifolia* HBK. Grashoff (1972)
further indicated that the nomenclaturally correct name for this
taxon may be *Stevia suaveolens* Lag.

Stevia origanoides HBK., Nov. Gen. Sp. Pl. 4: 115. 1818.

A note on the label of an herbarium specimen (*Hinton 2277 at F*)
collected in 1932 in the Temascaltepec District of Mexico
states that this plant is known as *Amargo*, which means bitter.

Stevia ovata Willd., Enum. Hort. Berol. 855. 1809.

Von Reis Altschul reported (1973) that a note on the label of
an herbarium specimen (*Steyermark 51753*) collected in Gua-
temala and identified as *S. rhombifolia* HBK. states that this
plant is known as *Flor de Plata* and *Tuán*. Later taxonomic
study (Grashoff, 1972) showed that *Steyermark 51753* belongs
to *S. ovata* Willd.

Under the name of *S. rhombifolia* HBK. var. *typica* B. L.
Robins., Martínez (1979) reported that this plant is known in
Huejutla in the State of Hidalgo, Mexico, as *Cualitaquinina*.
According to Grashoff (1972), *S. rhombifolia* HBK. var. *rhom-*

bifolia, that is var. *typica* of B. L. Robins., is synonymous with *S. ovata* Willd.

Stevia petiolata (Cass.) Sch.-Bip. in *Linnaea* 25: 291. 1853.

In Peru, this species is known as *Guarmi-guarmi* in the Rio Blanco area near Lima, and in the process of baking meat in a covered pit (a practice known as *pachamanca*) it is added to give flavor to the meat (Soejarto et al., 1983).

Stevia pilosa Lag., *Gen. Sp. Nov.* 26. 1816.

Von Reis Atschul (1973) reported that according to a note on the label of an herbarium specimen collected in Mexico in 1890, this species is known as *Flor de Maria*. Another report (Díaz, 1976b, p. 115) indicated that a plant under the name of *Stevia conferta* DC. is used in Mexico as an antimalarial, antipyretic, cathartic and diuretic. According to Grashoff (1972), this Latin binomial is synonymous with *S. pilosa* Lag.

Stevia polycephala Bertol. var. *polycephala* (Grashoff, 1972).

A note on the label of an herbarium specimen (*Molina and Molina 26362 at F*) collected at Huehuetenango Guatemala, states that this plant is known as *Mejorana*, without further details.

Stevia puberula Hook., *Bot. Miscell.* 2: 225. 1831.

According to von Reis Altschul (1973), a note on the label of an herbarium specimen collected in Peru in 1922 states that this species is known as *Lima-lima* and is used as “a tea substitute and stomach medicine”.

Stevia punensis B. L. Robins. in *Contr. Gray Herb.* 100: 8. 1932.

According to Herrera (1939) and Soukup (1970), this species is called *Enduchuína* in Peru, without further details. It is not clear if this is a Spanish, Portuguese or native name. It may be possible that the name has been derived from the Spanish word “endulzar” (to sweeten).

Stevia Rebaudiana (Bertoni) Bertoni in An. Cie. Parag., ser. I, 5: 1. 1905.

This is the "sweet herb of Paraguay", presently widely used in Japan as a sweetener. According to early reports by Gosling (1901) and Bertoni (1905, 1918) the leaves of this plant have been used by the natives of Paraguay since time immemorial to sweeten foods. One later report (Mazzei-Planas and Kuć, 1968) indicated that, additionally, the milled aerial parts are taken by women in Paraguay as a contraceptive.

The local use of the leaves of this plant as a food additive, for example to sweeten a *maté* beverage, was confirmed during a recent field work in Paraguay (Soejarto et al., 1983), but no confirmation could be obtained concerning the use of the plant as a contraceptive.

More recent reports (Angelucci, 1981; Soejarto et al., 1983) indicated that *S. Rebaudiana* is also used in Paraguay as a tea for the treatment of diabetes. Such use, however, appears to be of modern origin, due to reports on the hypoglycemic activity of extracts of the leaves of this plant (Soejarto et al., 1983). Angelucci (1981) further added that the plant is used to regulate arterial pressure in hypertensive persons.

Sakaguchi and Kan (1982) mentioned that historical evidence on the use of *S. Rebaudiana* as a sweetener in South America is found in the documents of the Spanish conquerors preserved in the National Archives in Asunción, Paraguay.

In Paraguay, *S. Rebaudiana* is known in the Guarani language as *Caá-êhê* (Gosling, 1901), and *Caá-êhê* and *Kaá-Hêé* (Bertoni, 1905, 1918), *Caá-ehe* and *Azucá-caá* (Cabrera, 1939), *Caá-hê-hê* or *Caá-enhem* (Mors and Rizzini, 1966), and *Ka-á Hê-e* (Soejarto et al., 1983) or by other renditions, all of which mean sweet herb. Pío-Corréa (1926) applied the name *Caá-ehé* erroneously to *Stevia collina* Gardner, believing that this is the sweet-tasting species. At the same time, *S. Rebaudiana* was confused with being a Brazilian plant growing in the areas of Minas Geráes, São Paulo and Matto Grosso, although in fact, the native territory of this species is the Cordillera of Amambay, Paraguay (Gosling, 1901; Bertoni, 1905, 1918; Sumida, 1973; Soejarto et al., 1983).

From a nomenclatural standpoint, the correct name of this taxon is *Stevia Rebaudiana* (Bertoni) Bertoni (1905), not *S. Rebaudiana* (Bertoni) Hemsley (1906), for reasons of priority.

***Stevia rhombifolia* HBK.**, Nov. Gen. Sp. Pl. 4: 112. 1818.

According to Grashoff (1972), the Latin binomial *Stevia rhombifolia* as applied to the North American specimens is very ambiguous and confusing, and refers to three distinct taxa: *S. jorullensis* HBK., *S. ovata* Willd. and *S. triflora* DC. However, its correct identity concerning the South American specimens is yet to be elucidated. In the present paper, ethnobotanical information associated with this Latin binomial is found under *S. ovata*, *S. nepetifolia* and under *Stevia* species (*Molinillo* and *Salvia*).

***Stevia salicifolia* Cav.**, Icon. Descr. Pl. 4: 32. 1797.

This species, whose distribution range extends from Mexico to southern United States (New Mexico), is known under various common names. The names used in Mexico are *Hierba del aire* (Hidalgo), *Hierba de la mula* (Guanajuato), *Zazal* (Sinaloa) and *Zazale de olor* (Martínez, 1979), and *Yerba de la mula* (von Reis Altschul, 1973). In addition, in the States of Michoacán and Mexico, it is known as *La envidia*, *Yerba de la mula* and *Zazal*. Small bundles of the dried aerial parts of *S. salicifolia* are offered for sale in the Juárez market of Toluca under the name of *Zazal*, where vendors advise that a water decoction or an alcoholic infusion may be used as a rub for rheumatism (Soejarto et al., 1983), whereas in the region of Morelia (Michoacán) the plant is used for the same purpose, but under the name of *Yerba de la mula*.

Under the name of *Stevia stenophylla* A. Gray, Martínez (1979) reported that this plant is called *Hierba de la Santa Rita* in the State of San Luis Potosi, Mexico. Grashoff (1972) considered this Latin binomial to be synonymous with *S. salicifolia* Cav.

***Stevia satureifolia* Sch.-Bip.** in Linnaea 25: 291. 1853.

A number of species of the Compositae (*Eupatorium*, *Mikania* and *Stevia*) are referred to as *Guaco* by Pío-Corréa (1952),

and stated to be “melíferas” or honey-bearing, including *S. satuireifolia* Sch.-Bip. from the Río Grande do sul, Brazil. Additionally, the common names *Charrúa*, *Tomillo silvestre* and *Yerba del Charrúa* used in Uruguay are attributed to this species. However, since Pío-Corréa followed the wide concept of *S. satuireifolia* as proposed by Baker (1876), who recognized five different varieties as the result of reduction of the same number of species, a concept which needs further re-examination (cf. Robinson, 1931a), it is not clear to which subspecific division each of the Uruguayan common names refers to.

Stevia serrata Cav., Icon. Descr. Pl. 4: 33. 1797.

A note on the label of an herbarium specimen (*Cominsky 74* at *F*) collected in Guatemala in 1974, as part of a project on medicinal plants, states that this plant is known as *Q'ang'aj* and used as a cough remedy. Another herbarium specimen (*Molina and Molina 26288* at *F*) bears a field label with a note, stating that the plant, collected in Huehuetenango, Guatemala, in 1971, is known as *Anís silvestre*. One report (Anonymous, 1929b) states that this species is also known in Guatemala as *Hipericón arrie*.

Without citing any reference, Díaz (1976a) stated that, in Mexico, the names *Tlalacxoyatl* and *Tlalchichinole* refer to *Stevia linoides*, a synonym of *S. serrata* Cav. (Grashoff, 1972).

Stevia subpubescens Lag. *var. intermedia* Grashoff in Brittonia 24: 392. 1972.

Soejarto et al. (1983) reported that in the Zitacuaro region in the State of Michoacán, Mexico, this plant is known as *Zazal*, and that the decoction of the aerial parts is used as a bath by women after parturition, whereas the leaves are used for stomachache. In the same report, it is mentioned that the medicinal herb vendors in the market of Patzcuaro (Michoacán), who call the plant *Hierba de la mula*, recommend its use to treat pains in the joints, by rubbing in the *fried* plant.

Stevia trifida Lag., Gen. Sp. Nov. 27. 1816.

According to a note on the label of an herbarium specimen collected in Mexico in 1898, this plant is known as *Manzanilla*

de agua, and an infusion of the roots and flowers is used to treat dysentery (von Reis Altschul, 1973).

***Stevia viscida* HBK.**, Nov. Gen. Sp. Pl. 4: 110, pl. 351. 1818.

In Mexico, this plant is known as *Matapulgas* and *Pipizhuatl* in the State of Jalisco, and as *Hierba de la pulga* in the State of Mexico (Martínez, 1979). The use of the name *Pipitzáhuatl* (Hernández, 1946; Martínez, 1979) for this species appears to have its origin in the work of Sessé and Moçino, who described *Ageratum purpureum* Sessé and Moçino (1893) and referred it to *Pipitzáhuatl*. *Ageratum purpureum* Sessé and Moçino is a synonym of *Stevia viscida* HBK. (Grashoff, 1972).

In Guatemala, this plant is known as *Mejorana*, according to a note on an herbarium specimen (*Molina and Molina 26559 at F*) collected in Huehuetenango.

STEVIA SPECIES

Uses of several *Stevia* species are reported in the literature, but the specific identities of the plants are presently either unknown or questionable. Among such reports are those found in the book *Natural History of Plants of the New Spain* written by Francisco Hernández, a Spanish physician, between 1570 and 1576. This book has been published several times in Latin and Spanish, between 1605 and 1959 (Hernández, 1959). In this book, plants listed under their Nahuatl names are given brief descriptions concerning botanical characteristics and medicinal virtues, and sometimes provided with illustrations. The rich information contained in this book has prompted Schultes (1962) to call it an "incredible treasury". It is also considered as a very reliable source of information by del Pozo (1969). A relatively recent edition of the book was published in Spanish, in 3 volumes (Hernández 1942: vol. 1, 1943: vol. 2, 1946: vol. 3). In this edition, the editors have provided a tentative identification or, more correctly, interpretation, to a great number of the plants. Thus, the equivalent Latin binomials are provided. In spite of these Latin binomials and the remarkable accuracy of interpretation, the final and correct botanical identity of many

of the plants, including species of *Stevia*, remains the subject of conjecture.

Stevia or possible *Stevia* species mentioned in Hernández's book and others reported elsewhere are listed below, according to their vernacular names, in alphabetical order.

1. ALBAHACA DEL CAMPO

A species of *Stevia* collected in Argentina in 1936 and referred to as *Albahaca del campo* is listed in von Reis Altschul's book (1973), without further details.

2. ANONIMA MECHOACANENSE

In Hernández's book (1943, p. 481), a plant referred to as third *Anonima mechoacanense* is listed, and has been interpreted as a *Stevia* sp. From the illustration provided, it can be said that it is not a species of *Stevia*, since the illustrated plant has verticillate (in 5's) leaves, which does not occur in *Stevia*. Interestingly, Hernández's text stated that his notes concerning the uses of plant were lost, hence the use of the word *Anonima*, which means anonymous.

3. CAMOPALTIC

Several plants in Hernández's book are called the first, second and third *Camopaltic*, a Nahuatl word which means herb with purple color. The identity of the third *Camopaltic* is given as *Stevia clinopodia* DC. (Hernández, 1946, p. 844). According to Grashoff (1972), the legitimate name for *S. clinopodia* DC. is *S. jorullensis* HBK. An illustration of the plant is here reproduced (Fig. 1).

Concerning uses, Hernández noted that the plant is a "cold herb", and that "half an ounce of the roots taken with water evacuates the urine".

In an earlier work by Urbina (1906), the third *Camopaltic* was given a different interpretation as either *Stevia linooides*, *S. laxiflora*, *S. purpurea* or *S. paniculata*, but it was noted that the most likely was *S. linooides*, due to the similar form of the leaves to flax. These Latin binomials are all illegitimate names and, according to Grashoff (1972), their legitimate names are *Stevia*



Fig. 1. A photograph of the third *Camopaltic* from Hernandez's book, *Natural History of the Plants of the New Spain*, Spanish edition (Mexico), vol. 3, p. 844, 1946. See text for further details.

serrata Cav. (for *S. linoides* Sch.-Bip.), *S. viscida* HBK. (for *S. laxiflora* DC). and *S. ovata* Willd. (for *S. paniculata* Lag.). As to *S. purpurea*, Grashoff stated that this is an ambiguous name, which includes elements belonging to *S. viscida* HBK., *S. pilosa* Lag., *S. Eupatoria* (Spreng.) Willd. and *S. porphyrea* McVaugh.

Since species of *Stevia* are delimited not only on the basis of vegetative and inflorescence characters, but also on the basis of minute floral and achene characters, which cannot be verified

from the illustration, the correct species identity of the third *Camopaltic* remains unanswered.

4. CIHUAPATLI PITZAHOAC

A plant with this name is listed in Hernández's book (1946, p. 894) and has been interpreted as *Stevia viscida* HBK. It is stated that it has "... a slightly bitter taste. The leaves applied prevent the fall of hair".

The interpretation of this plant as *S. viscida* appears to have been due to the fact that in some parts of Mexico, the common name for this species is *Pipitzáhuatl* (see note under *S. viscida*, above). However, very similar names are used for *Perezia* and *Eupatorium* species (Martínez, 1969).

5. CIHUAPATLI YACAPICHTLENSE

A plant under this name is listed in Hernández's book (1946, p. 888) and has been interpreted as either *Baccharis glutinosa* Pers., *Stevia viscida* HBK. or *S. salicifolia* Cav. An illustration provided (1946, p. 889, fig. 215) depicts a plant with alternate leaves, which corresponds to either a *Baccharis* species or *S. viscida*, but not to *S. salicifolia*, which has opposite leaves. According to the description, the plant has purple flowers, common in *Stevia*, whereas *Baccharis* has a yellowish flower color.

The word *Cihuapatli* means, in the Nahuatl language, medicine for women, whereas the epithet *yacapichtlense* refers to the locality of the plant in the State of Morelos, presumably used in order to distinguish it from the 22 other Cihuapatlis mentioned in the text.

The properties of *Cihuapatli yacapichtlense* are stated thus: "Its decoction drunk or applied resolves admirably the humours which have penetrated the joints and nerves, and calms any pains by eliminating their cause" (Hernández, 1946, p. 888). In the same text, the plant is also referred to as *Pitzahoaccihuapatli*.

6. KAADYUPÉ

This name was used by Bertoni (1914) to refer to a species of *Stevia* from Paraguay, but without further details.

7. MOLINILLO

Pittier (1926, p. 300) mentioned that *Stevia urticifolia* Thunb. is known in Venezuela as *Molinillo*. However, a case of misidentification appears to be involved, which is evident from the following statement by Robinson (1931b):

"*S. urticifolia* Thunb., as employed by Knuth, covers material collected by Pittier and by Jahn, which was in part *S. Wageneri*, in part *S. rhombifolia* var. *stephanocoma* Sch.-Bip and as to the rest *S. elatior* HBK., while the real *S. urticaefolia* Billb. ex Thunb. is a Brazilian plant as yet unknown from Venezuela".

It is interesting to note that von Reis Altschul (1973) enumerated *Molinillo* under *Stevia elongata* HBK. var. *caracasana* (DC.) B. L. Robins., based on information from a specimen (*Jahn 1098*) collected from Venezuela. (See note under *S. caracasana*, above). This same specimen has been identified by Robinson (1931b) as *S. elongata* var. *caracasana*, but without associating it with the common name *Molinillo*.

One suspects that Pittier may have referred to one and the same specimen, i.e. *Jahn 1098*.

8. PERICÓN BLANCO

Martínez (1969) considered that a plant known under this name in the Tasco region of Mexico is a species of *Stevia*, and that "... dried leaves and flowers, boiled in water with salt, are used against colic".

9. SALVIA

According to one report (Anonymous, 1929b), *S. rhombifolia* HBK. is known in Guatemala as *Salvia*.

Grashoff (1972), however, considered that the Latin binomial *S. rhombifolia* is very ambiguous and has been confused by different authors, and actually refers to three distinct species: *S. ovata* Willd., *S. triflora* DC. and *S. jorullensis* HBK. Based on this concept, the identity of *Salvia* is not known with certainty.

10. TLACOHICHIC DE OCOPETLAYUCA

A plant under this name is listed in Hernández's book (1943,

p. 583) and has been interpreted as a species of *Stevia*. *Tlaco-chic* means, in the Nahuatl language, bitter stem.

The uses of the plant are stated as follows: "... the juice of an ounce of the root drunk with water evacuates the phlegmatic humors through the inferior conduit. It is hot and tastes acrid and bitter. The people from the Panuco region (Veracruz, Mexico) say that it cures scabies and abdominal pains, and reduces the spleen".

11. TLALCHICHINOLE

According to Martínez (1969) a plant known as *Tlalchichinole* in the Guerrero State, Mexico, belongs to *Stevia*, and a decoction is used to wash infected pimples. See also note under *Stevia serrata*.

12. TONALXIHUITL

Twelve plants under this name are listed in Hernández's book (1942) and one of these, which is referred to as first *Tonalxihuitl* (Hernández, 1942, p. 56) has been interpreted as *Stevia salicifolia* Cav. The description corresponds to the characteristics of this species, but no illustration is provided, for purposes of comparison. The text states that the roots of the plant are "... excellent in reducing fevers, when crushed and rubbed or drunk in a dose of an ounce".

Another plant called *Tonalxihuitl yacapichtlense* has been interpreted as *Veronica americana* Schwein. ex Benth. (Hernández, 1942, p. 57).

In the Nahuatl version of the 16th century Florentine Codex written under the direction of Bernardino Sahagún, using direct information from Aztec physicians, there are three mentions of *Tonalxihuitl* plants, which, in the English translation of this codex (Sahagún, 1961, 1963), are interpreted, following Hernández's book, as *Stevia salicifolia* or *Veronica americana*. According to the illustration provided (Sahagún, 1963, fig. 574), the plant has alternate leaves, which do not correspond to the characteristic of *S. salicifolia*. Under the section of the book which "... telleth of the ailments of the body and of the medicine ...", *Tonalxihuitl* is stated to be used as follows:

“If the chest, the back, the ribs, the rib cage hurt, if she aches in all parts of her body, she is anointed with a collection of diverse herbs: *Tlaquequetzal*, *Tonalxihuitl*, *Alzitzicaztli*, *Atzomiatl*. They are ground; they are mixed with lampblack and *Axin* in order to be applied as an ointment. But first she is to bathe in hot wormwood (water).” (Sahagún, p. 1961, p. 152).

In another section which “. . . telleth of the medicinal herbs . . .”, *Tonalxihuitl* is stated to be used as follows:

“[The foliage] is ground up. It is required by one who has pimples. Moistened, it is placed there where the pimples are.

And its root is useless, of no value. And this one, when someone tastes it, deadens the tongue somewhat”. (Sahagún, 1963, p. 167).

DISCUSSION

On the basis of the data presented above, the following observations can be made.

1. The application of the same common name(s) to more than one species.

Several cases may be cited, in which the common names have been applied to more than one *Stevia* species. The reasons for this are not always clear, but in some cases an explanation may be in order.

For example, the common names *Hierba de la mula* and *Zazal* are used in the central part of Mexico for *S. salicifolia* and *S. subpubescens*. The basis for this appears to be morphological similarity. Both species are shrubs with linear to lanceolate leaves, and with dense corymbs of white capitula. Additionally, the distribution of the two species overlaps in this geographic region. Another similar example is the use of the name *Hierba del aire* for both *S. lucida* and *S. salicifolia*, morphologically similar species.

On the other hand, the name *Hierba de la pulga* has been applied to *S. glandulosa* and *S. viscida*, two morphologically distinct species (see also Grashoff, 1972). Apparently, in this case, the basis is similarity of uses of the plants, namely as insect repellents. *Hierba de la pulga* means the flea's herb. The application of the name of *Hierba de aire* for both *S. lucida* and *S. salicifolia* may also be explained on the basis of similarity in use.

As for the application in Guatemala of the common name *Mejorana* for *S. jorullensis*, *S. polycephala* and *S. viscida*, the reason is not clear, since these three species are not related taxonomically, or are morphologically similar (Grashoff, 1972). It may be noted, however, that the word *Mejorana* in Spanish is often used to refer to aromatic herbs, such as *Origanum Majorana* L. (sweet marjoram).

To cite another example, the common name *Oreja de ratón* (mouse's ear) has also been applied to *S. hirsuta* and *S. lehmannii*, two taxonomically unrelated species.

2. Pharmacological studies

Of all the species enumerated in this paper, only *Stevia Rebaudiana* has been investigated most thoroughly, in terms of its botany, phytochemistry and pharmacology (Felippe, 1977; Angelucci, 1981; Sakaguchi and Kan, 1982). Obviously, this has been due to the sweet properties of this plant, and to its potential as a sweetener.

Aside from *S. Rebaudiana*, only in one other species, namely *S. Eupatoria*, have observations on the pharmacological effects of its crude extracts been made. Thus, a series of reports (Armendaris, 1905; Loaeza, 1905; Lozano y Castro, 1905; Martínez del Campo, 1905; Ruíz, 1905; Villasenor, 1905; Flores, 1907) were published at the beginning of this century, detailing the results of experiments in rabbits, sheep and pigeons, as well as clinical observations in humans, using water infusions of *Stevia Eupatoria*. These experiments were performed at the Instituto Medico Nacional in Mexico, in an attempt to verify the diuretic, antimalarial and toxic effects claimed for the plant.

The results of these studies were summarized as follows (Flores, 1907):

- i. Dried plants, when ingested by rabbits and sheep, did not produce any toxicity.
- ii. In the pigeon, a water infusion produced a purgative effect, even when administered intravenously.
- iii. In rabbits, no increase of urinary secretion was produced after administration.
- iv. Clinical observations of the root decoction as a diuretic showed that it worked in the majority of cases, but a defini-

tive pharmacological action leading to the stimulation of diuresis was not demonstrated.

- v. As an antimalarial, various preparations (decoction, tincture, and fluid extract) of the roots administered orally showed negative results, except in one case.
- vi. Toxic effects in humans included nausea, vomiting and diarrhea, at a daily dose of 200 g of a 10% decoction, in more sensitive individuals.

3. Phytochemical basis of ethnomedical uses

The diverse folk medicinal uses of *Stevia* species perhaps stem from the bitter taste of its members (Soejarto et al., 1983), a property often associated with medicinal virtues. This bitter taste is probably due to the presence of sesquiterpene lactones (Rodriguez et al., 1976; Rodriguez, 1977) or to certain diterpenes (Cocker, 1966; Sticher, 1977). Sesquiterpenes appear to be characteristic in plants of the Compositae (Hegnauer, 1977; Herz, 1977), and have been isolated previously from several species of *Stevia* (Ríos et al., 1967; Salmón et al., 1973; Rodríguez et al., 1976; Salmón et al., 1977; Bohlmann et al., 1979, 1982). The extent to which these principles are responsible for alleged therapeutic activities in members of *Stevia* remains to be investigated.

Many species of *Stevia* exhibit a pungent to pleasantly aromatic odor, which in certain species has been referred to by Grashoff (1972) as a goat's smell. Strong and aromatic odors from plants are due to the presence of essential oils, which possess rubefacient, irritant and antimicrobial properties (Harvey, 1975). Montés (1969) and Fujita et al. (1977) have demonstrated the presence of volatile constituents in *Stevia satureifolia* and *S. Rebaudiana*, respectively. This attribute may be responsible for certain alleged therapeutic uses, such as antipyretics, anti-rheumatics, diaphoretics, and to treat burns, scratches, and skin diseases.

For other therapeutic activities, for which species of *Stevia* have been allegedly used, as antidiarrheals, uterine relaxants (antidysmenorrheics), in the prevention of hair from falling, and in cardiac treatments, to mention only a few, the phytochemical basis is not known at present.

ACKNOWLEDGMENTS

The present investigation has been supported, in part, by contract NIH-N01-DE-02425 with the National Institute of Dental Research, National Institutes of Health, Bethesda, Maryland, U.S.A.

We wish to thank Dr. William C. Burger, Chairman of the Botany Department, Field Museum of Natural History, Chicago, for the kind permission in the use of the *Stevia* herbarium collection for the present study.

One of us, CMC, wants to thank the National Research Council of Mexico (CONACYT) for financial support during this study.

LITERATURE CITED

- Abe, K. and M. Sonobe. 1977. Use of stevioside in the food industry. *New Food. Industr. (Japan)* 19: 67-72.
- Angelucci, E. (Coordinator) 1981. I Seminario Brasileiro sobre *Stevia Rebaudiana* Bertoni. ITAL: Campinas, 25 e 26 de Junho de 1981. (Abstracts of papers) Governo do Estado de São Paulo, Secretaria de Agricultura e Abastecimento, Coordenadoria da Pesquisa Agropecuária, Instituto de Tecnologia de Alimentos (ITAL).
- Anonymous. 1929a. Catalogo de plantas reputadas medicinales en la Republica de Guatemala, 2nd ed., p. 32. Tipografía Nacional, Guatemala C.A.
- Anonymous. 1929b. Flora de Guatemala. Ministerio de Agricultura.
- Armendaris, E. 1905. Yerba del borrego (*Stevia eupatoria*). *An. Inst. Med. Nac. (Mexico)* 7:10-12.
- Baker, J. G. 1876. Compositae II. Eupatoriaceae: *Stevia*. In *Flora Brasiliensis*, vol. 6, part 2/2, C.F.P. de Martius, ed., Monachii, Lipsiae apud Frid. Fleischer, pp. 199-211, pls. 55-58.
- Bertoni, M. S. 1905. Le Kaá Hê-e: sa nature et ses proprietes. *An. Cie. Parag. ser. I*, 5: 1-14.
- 1914. Plantas Usuales del Paraguay y Paises Limítrofes. Descripción Física y Económica del Paraguay No. 31, issue 1, p. 75. Establecimiento Grafico, M. Brossa, Asunción.
- 1918. La *Stevia Rebaudiana* Bertoni. La estevina y la rebaudina: nuevas substancias edulcorantes. *An. Cie. Parag. ser. 2*, 2: 129-134.
- Bohlmann, F., L. N. Dutta, W. Dorner, R. M. King and H. Robinson. 1979. Zwei neue Guajanolide sowie weitere Longipinester aus *Stevia*-Arten. *Phytochemistry* 18: 673-675.
- Bohlmann, F., C. Zdero, R. M. King and H. Robinson. 1982. Sesquiterpenes, guaianolides and diterpenes from *Stevia myriadenia*. *Phytochemistry* 21: 2021-2025.

- Cabrera, A. L. 1939. Las Compuestas Útiles Cultivadas en la Republica Argentina, p. 14. Ministerio de Obras Públicas de la Provincia de Buenos Aires, Dirección de Agricultura, Ganadería e Industria.
- Cardenas, M. 1943. Notas Preliminares sobre la Materia Médica Boliviana. Sinopsis de la Flora Médica de Bolivia, p. 22. Imprenta Universitaria, Cochabamba, Bolivia.
- Cocker, W. 1966. Some aspects of the chemistry of diterpene bitter principles. *Pl. Med.* 14 (Suppl.): 78-85.
- Cortés, S. Not dated. Flora de Colombia, pp. 153, 246, 260. Libreria del Mensajero, 2nd ed., Bogotá.
- Del Pozo, E. C. 1979. Empiricism and Magic in Aztec Pharmacology. *In Ethnopharmacologic Search for Psychoactive Drugs*, D. H. Efron, B. Holmstedt and N. S. Kline, eds., pp. 59-76. Raven Press, New York.
- Díaz, J. L., ed. 1976a. Índice y Sinonimia de las Plantas Medicinales de Mexico, p. 97. Monografías Científicas I, IMEPLAM, Mexico.
- 1976b. Usos de las Plantas Medicinales de Mexico, pp. 115, 316. Monografías Científicas II, IMEPLAM, Mexico.
- Felippe, G. M. 1977. *Stevia Rebaudiana* Bert.: uma revisão. *Cienc. Cult.* 29: 1240-1248.
- Flores, L. 1907. Manual Terapeutico de las Plantas Mexicanas. Yerba del borrego (*Stevia Eupatoria*). *An. Inst. Med. Nac. (Mexico)* 9: 369-370.
- Fujita, H. and T. Edahiro. 1979. Safety and utilization of *Stevia* sweetener. *Shokuhin Kogyo* 22: 66-72.
- Fujita, S.-I., K. Taha and Y. Fujita. 1977. Miscellaneous contributions to the essential oils of the plants from various territories. XLI. On the components of the essential oils of *Stevia Rebaudiana* Bertoni. *Yakugaku Zasshi* 97: 692-694.
- Gosling, C. 1901. Caá-êhê or azucá-caá. A letter from C. Gosling, British Consul to Asunción, Paraguay, to the Kew Herbarium. *Kew Bull.* 1901: 173-174.
- Grashoff, J. L. 1972. A Systematic Study of North and Central American Species of *Stevia*. Ph.D. diss., Univ. Texas, Austin. Univ. Mich. Microfilm No. 73-7556.
- Harvey, S. C. 1975. Topical Drugs. *In Remington's Pharmaceutical Sciences*, 15th ed., Mack Publ. Co., pp. 719-722.
- Hegnauer, R. 1977. The chemistry of the Compositae. *In The Biology and Chemistry of the Compositae*, V. H. Heywood, J. B. Harborne and B. L. Turner, eds., vol. 1, p. 283-335. Academic Press, London, New York, San Francisco.
- Hemsley, W. B. 1906. Tabula 2816: *Stevia Rebaudiana* Hemsl. *In Hooker's Icones Plantarum*, 4th ser., vol. 9, D. Prain, ed., pl. 2816. Dulau and Co., London.
- Hernández, F. 1942. Historia de las Plantas de Nueva España, vol. 1. Instituto de Biología, UNAM, Imprenta Universitaria, Mexico.
- 1943. Historia de las Plantas de Nueva España, vol. 2.
- 1946. Historia de las Plantas de Nueva España, vol. 3.
- 1959. Obras Completas Tomo II: Historia Natural de Nueva España, vol. 1. Universidad Nacional de Mexico.
- Herrera, F. L. 1930. Estudios sobre la Flora del Departamento del Cuzco, pp. 187, 227. Sanmarti y Cia., Lima.

- _____ 1939. Catálogo Alfabético de los Nombres Vulgares y Científicos de Plantas que existen en el Perú. Universidad Mayor de San Marcos, Lima.
- Herz, W. 1977. Sesquiterpene lactones in the Compositae. *In* The Biology and Chemistry of the Compositae, vol. 1, V. H. Heywood, J. B. Harborne and B. L. Turner, eds., p. 337-357. Academic Press, London, New York, San Francisco.
- Kamiya, S., F. Konishi and S. Esaki. 1979. Synthesis and taste of some analogs of stevioside. *Agr. Biol. Chem.* 43: 1863-1867.
- Kazuyama, S. 1979. Present status of natural sweeteners from *Stevia*. *Shokuhun to Kagaku (Japan)* 21: 90-94.
- Kinghorn, A. D., N. P. D. Nanayakkara, D. D. Soejarto, P. J. Medon and S. K. Kamath. 1982. Potential sweetening agents of plant origin. I. Purification of *Stevia Rebaudiana* sweet constituents by droplet counter-current chromatography. *J. Chromatogr.* 237: 478-483.
- Latorre, D. L. and F. A. Latorre. 1977. Plants used by the Mexican Kickapoo Indians. *Econ. Bot.* 31: 340-357.
- Lipp, F. J. 1971. Ethnobotany of the Chinantec Indians, Oaxaca, Mexico. *Econ. Bot.* 25: 234-244.
- Loeza, A. A. 1905. La Hierba del borrego (*Stevia eupatoria*). *An. Inst. Med. Nac. (Mexico)* 7:106, 380.
- Lozano y Castro, M. 1905. Conclusion del analisis de la Yerba del borrego (*Stevia eupatoria*). *An. Inst. Med. Nac. (Mexico)* 7: 40-42.
- Martínez, M. 1969. Las Plantas Medicinales de Mexico, 5th ed., p. 163, 476. Ediciones Botas, Mexico.
- _____ 1979. Catálogo de Nombres Vulgares y Científicos de Plantas Mexicanas. Fondo de Cultura Economica, Mexico.
- Martínez del Campo, J. 1905. Hierba del borrego (*Stevia eupatoria*). *An. Inst. Med. Nac. (Mexico)* 7: 46, 51, 80-81, 105, 161-162, 196, 268, 301-302, 450.
- Mazzei-Planas, G. and J. Kuć. 1968. Contraceptive properties of *Stevia Rebaudiana*. *Science* 162: 1007.
- Montés, A. L. 1969. La cromatografía gaseosa aplicada en el estudio de algunos aceites esenciales de plantas nativas del centro norte Argentinos. *An. Soc. Cient. Argent.* 182: 33.
- Mors, W. B. and C. T. Rizzini. 1966. Useful Plants of Brazil, p. 93. Holden-Day Inc., San Francisco.
- Morton, J. F. 1975. Current folk remedies of northern Venezuela. *Quart. J. Crude Drug Res.* 13: 97-121.
- Pérez-Arbeláez, E. 1936. Plantas Útiles de Colombia, tomo I, p. 60. Imprenta Nacional, Bogotá.
- _____ 1937. Plantas Medicinales y Venenosas de Colombia, p. 280. No Publisher, Bogotá.
- Pío-Corrêa, M. 1926. Dicionario das Plantas Úteis do Brasil, 1st ed., Vol. 1, p. 348. Imprensa Nacional, Rio de Janeiro.
- _____ 1952. Dicionario das Plantas Úteis do Brasil, 2nd ed., vol. 3, p. 517-519. Ministerio de Agricultura, Serviço de Informação Agrícola, Rio de Janeiro.
- Pittier, H. 1926. Manual de las Plantas Usuales de Venezuela, pp. 209, 300. Litografía del Comercio, Caracas.

- Ríos, T., A. Romo de Vivar and J. Romo. 1967. Stevin, a new pseudoguaianolide isolated from *Stevia rhombifolia* HBK. *Tetrahedron* 23: 4265-4269.
- Robinson, B. L. 1930a. The Stevias of the Argentine Republic. *Contr. Gray Herb.* 90: 58-79.
- . 1930b. The Stevias of Paraguay. *Contr. Gray Herb.* 90: 79-90.
- . 1930c. The Stevias of North America. *Contr. Gray Herb.* 90: 90-159.
- . 1931a. The Stevias of Colombia. *Contr. Gray Herb.* 96: 28-36.
- . 1931b. The Stevias of Venezuela. *Contr. Gray Herb.* 96: 37-43.
- . 1931c. The Stevias of Ecuador. *Contr. Gray Herb.* 96: 43-49.
- . 1932a. The Stevias of Peru. *Contr. Gray Herb.* 100: 20-36.
- . 1932b. The Stevias of Bolivia. *Contr. Gray Herb.* 100: 37-69.
- Rodríguez, E., G. H. N. Towers and J. C. Mitchell. 1976. Biological activities of sesquiterpene lactones. *Phytochemistry* 15: 1573-1580.
- Rodríguez, E. 1977. Sesquiterpene lactones: chemotaxonomy, biological activity and isolation. *Rev. Latinoamer. Quím.* 8: 56-62.
- Roig y Mesa, J. T. 1953. *Diccionario Botánico de Nombres Vulgares Cubanos*, vol. 1, p. 381. Seoane, Fernández y Cia.
- Ruiz, L. E. 1905. Descripción botánica de la yerba del borrego (*Stevia eupatoria*). *An. Inst. Med. Nac. (Mexico)* 7: 5.
- Sahagún, F. B. de. 1961. *Florentine Codex: General History of the Things of New Spain*. Edited and translated by A. J. D. Anderson and C. E. Dibble. Monograph No. 14, part 11, p. 152. The school of American Research and the University of Utah, Santa Fé, New Mexico.
- . 1963. *Florentine Codex: General History of the Things of New Spain*. Monograph No. 14, part 12, pp. 167, 178, 197.
- Sakaguchi, M. and T. Kan. 1982. As pesquisas Japonesas com *Stevia Rebaudiana* (Bert.) Bertoni e o esteviosídeo. *Cienc. Cult.* 34: 235-248.
- Salmón, M., E. Díaz and A. Ortego. 1973. Christinine, a new epoxyguaianolide from *Stevia serrata* Cav. *J. Org. Chem.* 38: 1759-1760.
- Salmón, M., E. Díaz and A. Ortego. 1977. Epoxilactonas de *Stevia serrata* Cav. *Rev. Latinoamer. Quím.* 8: 172-175.
- Schultes, R. E. 1962. The role of the ethnobotanist in the search for new medicinal plants. *Lloydia* 25: 257-266.
- Sessé, M. and J. M. Mocino. 1893. *Plantae Novae Hispaniae*, p. 120. Oficina Tipografica de la Secretaria de Fomento, Mexico.
- Soejarto, D. D., C. M. Compadre, P. J. Medon, S. K. Kamath and A. D. Kinghorn. 1983. Potential sweetening agents of plant origin. II. Field search for sweet-tasting *Stevia* species. *Econ. Bot.* 37: 71-79.
- Soukup, J. 1970. *Vocabulario de los Nombres Vulgares de la Flora Peruana*. Colegio Salesiano, Lima. p. 329.
- Sticher, O. 1977. Plant mono-, di- and sesquiterpenoids with pharmacological or therapeutical activity. *In New Natural Products and Plant Drugs with Pharmacological, Biological or Therapeutical Activity*, H. Wagner and P. Wolff, eds., p. 137-176. Springer-Verlag, Berlin, New York.
- Sumida, T. 1973. Reports on *Stevia Rebaudiana* Bertoni introduced from Brazil as a new sweetness resource in Japan. *Miscell. Publ. Hokkaido Natl. Agr. Exp. Sta. No. 2*, p. 69-83.

- Tanaka, O. 1980. Chemistry of *Stevia Rebaudiana*. Saengyak Hakhoe Chi 11: 219-227.
- Urbina, M. 1906. Raices Comestibles entre Los Antiguos Mexicanos, p. 154. Imprenta del Museo Nacional, Mexico.
- Villasenor, F. E. 1905. La Hierba del borrego (*Stevia Eupatoria*). An. Inst. Med. Nac. (Mexico) 7: 156.
- von Reis Altschul, S. 1973. Drugs and Foods from Little-known Plants, p. 298-299. Harvard University Press, Cambridge, Mass.
- Index Kewensis Plantarum Phanerogamarum, vol. 1 and 2 (1895), Suppls. 1-16 (1906-1981). Oxonii, e Prelo Clarendoniano.